BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : B64D 11/06

A1

(11) International Publication Number: WO 92/06003

(43) International Publication Date: 16 April 1992 (16.04.92)

(21) International Application Number: PCT/GB91/01685

(22) International Filing Date: 30 September 1991 (30.09.91)

(30) Priority data:
9021146.7 28 September 1990 (28.09.90) GB

(71) Applicant *(for all designated States except US)*: H.W. STRUCTURES LIMITED [GB/GB]; Southam Road, Radford Semele, Leamington Spa, Warwickshire CV31 1FQ (GB).

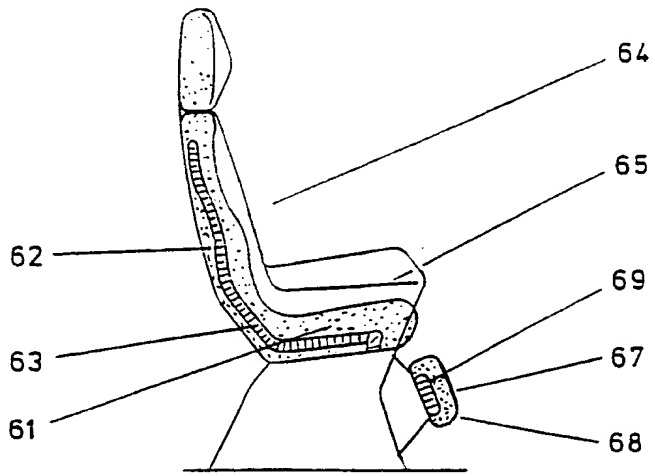
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : ROCK, Nibel, Ian, Christopher [GB/GB]; The Rosary, Rose Lane, Napton on the Hill, Near Rugby, Warwickshire CV23 8YP (GB).

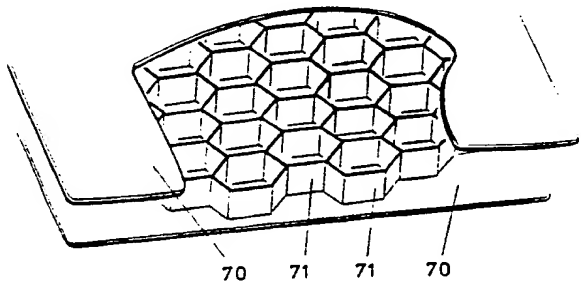
(74) Agent: WITHERS & ROGERS; 4 Dyers's Buildings, Holborn, London EC1N 2JT (GB).

(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.

(54) Title: A SEAT ASSEMBLY





(57) Abstract

A seat assembly (60) includes a rigid cellular structure (63) such as an aluminium honeycomb or an aluminium foam. The structure (63) is wall-like and arranged to absorb impact applied to at least part of the seat (60) by deformation of the cellular structure (63). The wall-like structure (63) may be provided in the seat base (61) contoured to the support surface (65) of the seat base (61). The seat may be rearwardly facing in an aircraft and the seat base may be tiltable backwards so that an occupant does not slide out of the seat on take-off or climb of the aircraft.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	ES	Spain	MG	Madagascar
AU	Australia	FI	Finland	ML	Mali
BB	Barbados	FR	France	MN	Mongolia
BE	Belgium	GA	Gabon	MR	Mauritania
BF	Burkina Faso	GB	United Kingdom	MW	Malawi
BG	Bulgaria	GN	Guinea	NL	Netherlands
BJ	Benin	GR	Greece	NO	Norway
BR	Brazil	HU	Hungary	PL	Poland
CA	Canada	IT	Italy	RO	Romania
CF	Central African Republic	JP	Japan	SD	Sudan
CG	Congo	KP	Democratic People's Republic of Korea	SE	Sweden
CH	Switzerland			SN	Senegal
CI	Côte d'Ivoire	KR	Republic of Korea	SU+	Soviet Union
CM	Cameroon	LI	Liechtenstein	TD	Chad
CS	Czechoslovakia	LK	Sri Lanka	TG	Togo
DE*	Germany	LU	Luxembourg	US	United States of America
DK	Denmark	MC	Monaco		

+ **Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.**

A SEAT ASSEMBLY

The invention relates to a seat assembly.

It is known in seats for helicopters to include a shock absorber, similar to an automatic shock absorber, under the seat assembly so that in the event of an accident where the helicopter falls to the ground, some of the shock impact will be absorbed for a seat occupant. It is also known, with the same object, to provide seats in helicopters with legs which are arranged to deform to absorb impact. A problem may arise with both of these known constructions, in that the seat assembly is allowed to drop towards the floor and if another person is sitting behind the seat, their feet or legs may be trapped or injured by it.

According to one aspect of the invention there is provided a seat assembly including a rigid cellular structure, the cellular structure being arranged to absorb impact applied to at least part of the seat by deformation of the cellular structure.

Deformation of the cellular structure can thus absorb impact.

The term "cellular structure" as used herein is intended to encompass both a structure of closed cells and an open cell structure (a sponge being an example of an open cell structure).

The cellular structure may be elongate and may be arranged to absorb impact applied in a lateral direction thereto. Preferably the cellular structure is wall-like in shape and preferably is arranged to absorb impact applied in a direction perpendicular to the plane of the wall.

Preferably, a wall-like structure is provided in a seat base of the seat assembly and is arranged to absorb impact applied downwardly to the seat base. In this way, the seat assembly can absorb impact without the seat base moving downwardly. The term "seat base" as used herein refers to that portion of a seat assembly which a person sits on.

Often in an aircraft seat assembly, the seat base comprises a cushion mounted on a light panel on a rectangular frame supported by legs. In the case of an underside impact to the aircraft, a seat occupant's

thighs are urged against the front bar of the frame, in particular if the cushion panel breaks, and the seat occupant's thighs may be injured or even broken. It is an important feature of the use of the wall-like cellular structure that in such a case the load constituted by the occupant is spread over the wall-like cellular structure rather than concentrated at the front frame bar. The wall-like cellular structure thus provides continuous local support and impact absorption. Conveniently the plane of the wall-like cellular structure may be substantially parallel to the support surface of the seat base.

The wall-like cellular structure may in addition, or alternatively the arranged to absorb impact applied to the front of the seat base.

The seat assembly may include a seat back and the wall-like cellular structure may in addition, or alternatively be in the seat back and be arranged to absorb impact perpendicular to the support surface of the seat back. Conveniently, the plane of the wall-like cellular structure may be substantially parallel to the support surface of the seat back.

The seat assembly may have a calf support and the cellular structure may in addition or alternatively be

in the calf support and arranged to absorb impact applied to the support surface thereof.

The seat assembly may have a headrest and the cellular structure may be in the headrest and arranged to absorb impact applied to the support surface thereof.

According to another aspect of the invention there is provided a rigid cellular structure for use in a seat assembly according to the first aspect of the invention.

The cellular structure may be provided with a layer on one side or on both sides to form a sandwich.

The cellular structure may take any suitable form and in one preferred embodiment is a honeycomb structure. The honeycomb structure and/or the layers may be made from any suitable material and may be made from metal sheet, such as aluminium. Where the cellular structure is in a sandwich this may then be the known aluminium honeycomb sandwich. One such sandwich is disclosed in WO/GB89/00897. The honeycomb structure and/or the layers may be made from a composite material such as kevlar or carbon fibre. In another embodiment, the structure may be a foam which may be, for example, urethane foam, or the new

aluminium foam material such as disclosed in US 4973358.

In known aircraft, seats are normally forward facing. In the event of an accident involving frontal impact, passengers in the seats are thrown forwards, away from the seat. Rearwardly facing seats could be used, such that passengers in a frontal seat impact would be forced back against their seats and not thrown forwards, but there is then the problem that on take-off and climb of the aircraft, both acceleration of the aircraft and gravity are acting in the direction to urge a passenger out of his seat.

According to another aspect of the invention there is provided a seat assembly for use as a passenger seat in an aircraft, the seat assembly including a seat base, the seat base being tiltable backwards.

A passenger can thus sit up normally in the seat assembly when the aircraft is travelling levelly or descending and the seat base can be tilted backwards for take off or climb so that a passenger is not urged out of the seat.

According to another aspect of the invention there is provided an aircraft including a rearwards facing seat

comprising a seat base, the seat base being tiltable backwards.

The seat may also include a seat back which may also be tiltable backwards.

The seat back and seat base may be separately tiltable, but preferably are connected so as to be tiltable together. A structural member of the seat base may be integral with a structural member of the seat back such that the seat back and seat base are tiltable together.

The seat base may be tiltable to an angle of between 15° and 30° to the horizontal and preferably is tiltable to an angle of between 20° and 25°.

A foot rest may be provided for use when the seat base is tilted.

Where an aircraft is involved in a frontal impact and a passenger is in a rearwardly facing seat, the applicants have found that there is a tendency for the lower part of the legs and feet to be thrown back under the seat. Preferably therefore a calf support is provided.

Indeed according to a further aspect of the invention there is provided a seat assembly for use as a rearwardly facing seat in an aircraft, the seat

including a calf support.

According to another aspect of the invention there is provided an aircraft including a rearwards facing passenger seat, the seat including a calf support.

The calf support may be dimensioned to support at least half of the length of the calf of a seat occupant and the position of the calf support in relation to the seat base may conveniently be adjustable. Otherwise, the calf support may extend downwardly from the front edge of the seat base and in an alternative embodiment the calf support is dimensioned to support substantially the whole length of the calf.

Another problem identified by the applicants in the use of rearwards facing seats in aircraft is that in the case of a frontal impact, the arms of a passenger tend to be thrown outwards and backwards from him. The seat assembly therefore preferably includes arm rests including portions arranged to inhibit outwards sliding of an occupant's arms off the arm rests.

According to another aspect of the invention, there is provided a seat assembly for use as a rearwards facing passenger seat in an aircraft, the seat assembly

including arm rests having portions arranged to inhibit outward sliding of an occupant's arms off the arm rest.

According to a further aspect of the invention, there is provided an aircraft including a rearwards facing passenger seat assembly, the seat assembly including arm rests including portions arranged to inhibit outwards sliding of an occupant's arms off the arm rests.

Each said portion may suitably comprise an upstanding ridge along or adjacent the edge of each arm rest.

The seat assembly preferably includes a head rest which extends from the top of the seat back to above the top of the head of a seat occupant.

The seat assembly preferably includes portions on each side of the seat back to inhibit sideways sliding of the body of an occupant.

Five embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of the first embodiment,

Fig. 2 is a fragmentary detail view of the sandwich of the first embodiment,

Fig. 3 is a side elevation cross-section of the second embodiment,

Fig. 4 is a perspective view of the third embodiment,

Fig. 5 is a side elevation of the third embodiment,

Fig. 6 is a side elevation of the third embodiment in a tilted position,

Fig. 7 is a perspective view of the fourth embodiment,

Fig. 8 is a side elevation of the fourth embodiment,

Fig. 9 is a perspective view of the fifth embodiment,

Fig. 1 shows the first embodiment. In the seat assembly 60, the seat base padding 61 and seat back padding 62 are integral and are mounted on an aluminium honeycomb sandwich 63 which follows the desired contour of the support surfaces 64, 65 of the seat back padding 62 and seat base padding 61. The front surface 66 of the seat base in this context is considered a support surface and the honeycomb sandwich 63 follows the contour thereof. A calf support 67 is also provided in the form of padding 68 mounted on a honeycomb panel 69. A fragmentary detail view of the aluminium honeycomb sandwich 63 is shown in Fig. 2. The panel consists of two parallel outer layers 70 of the aluminium sheet having further

impact, the body of an occupant is forced against the seat assembly and the walls 71 of the hexagonal cells collapse absorbing impact energy and reducing the likelihood of injury to the occupant.

The walls of the hexagonal cells may be made of aluminium which is between 17μm and 64μm having a side wall length of between 5.2mm and 11.0mm a cell height of 25mm and a density for the structure if between 16kgm^{-3} and 29kgm^{-3}. The facing layer thickness may be 0.5mm. In tests using such honeycomb and applying a test load of between 2000N and 9000N over an area 200 x 360mm the honeycomb crushed satisfactorily.

In another embodiment foamed aluminium may be used in place of the honeycomb. A framed aluminium with a density of about 54kgm^{-3} would be suitable.

In another embodiment, the headrest of the seat assembly may also be formed as padding on an aluminium honeycomb sandwich.

Fig. 3 shows an embodiment which can be used in existing aircraft seats. Thus the seat assembly 60 comprises a seat frame 72 made from connected tubular steel bars. The bars normally support light panels. Fig. 3 shows a light panel 73 which is attached to two

steel bars. The bars normally support light panels. Fig. 3 shows a light panel 73 which is attached to two parallel transverse bars 74 to form a back panel of the seat around which the back padding 62 is provided. In the embodiment, a light panel, which is normally supported on two front and rear transverse bars 75 in the base of the seat, is removed and an aluminium honeycomb panel 76 is inserted instead. This may necessitate some cutting of the seat base padding 61. The panel 76 may be flat or may be contoured to the support surface 65 of the seat base padding 61.

In existing seats, in a downward crash, as discussed, the light base panel often breaks so that the forces on a seat occupant are concentrated at the front and rear transverse bars 75. This may result in femoral and tibial fractures and also in excessive lumbar loading over the limit defined in the new Survivability Regulations for Impact (FAA AC25.562.1). By means of the honeycomb panel distributed rather than localised support is provided to reduce the risk of injury to a seat occupant.

In the third embodiment, a rearwardly facing passenger seat for an aircraft 10 includes a seat base 11 and a seat back 12. Arm rests 13 are provided. From the front of the seat base 11, a calf support 14 extends

downwardly and at a slight forward angle. The calf support is of the same width as the seat base 11 and extends down to about the level of the top of the person's heel. The calf support 14 includes a central rectangular aperture which is elongate in the width direction of the calf support 14.

The seat back 12 of the seat assembly 10 is relatively broad in the shoulder area to ensure that it extends across the total width and height of an occupant's shoulders. At each side edge of the seat back 12, a ridge 16 extends forwardly.

A headrest 17 extends upwardly from the seat back 12. The headrest 17 also includes forwards projecting ridges 18 along its side edges.

In use, then, the calves of a seat occupant are supported by the calf support 14 so that they cannot be thrown back under the seat assembly in the event of a frontal impact on the aircraft. The seat occupant's shoulders are also supported by the seat back 12 and the ridges 16 prevent the occupant from sliding sideways out of the seat. Similarly, the ridges 18 on the headrest 17 ensure that the head is not thrown sideways off the headrest in an impact.

At either side of the seat assembly, in a position corresponding to the notional line on which the seat back and seat base meet, an outwardly extending spigot 19 is provided. Each spigot 19 is received in a bore in a seat mounting, the seat mounting including a locking mechanism (not shown) by means of which the seat assembly can be locked in two positions. In the first, normal position, the seat base 11 is horizontal or tilted backwards slightly. This is the position which the seat assembly will be in when the aircraft is travelling levelly. The mechanism also locks the seat assembly in the second position in which the entire seat assembly 10 is tilted backwards at an angle of 22.5° to the horizontal line and this is the position the seat assembly will be in for take-off and climb of the aircraft. As shown in Fig. 3, during climb of the aircraft the seat assembly is at a similar angle to the vertical as when in the normal position and the aircraft is travelling levelly. A footrest 20 is provided for use by the occupant when the seat assembly is in the tilted position. This may be carried by the seat assembly in front.

In other embodiments, the angle of the seat back and seat base may be adjusted independently, so that, for example, the seat back can be reclined without tilting of the seat base, if desired.

Figs. 7 and 8 show the fourth embodiment. The fourth embodiment is similar to the third and only the differences from the third embodiment will be described. The same reference numerals will be used for equivalent features.

The seat assembly 10 in the fourth embodiment is fixedly mounted by a seat mounting 21. The seat mounting 21 comprises a base 22 which extends under the seat assembly and is secured to the floor of the aircraft, and two arms 24 which extend from either side of the base 22 up to the calf support 14.

Along the outer edge of each arm rest 13 is provided a raised ridge 23.

In use, a seat occupant's arm lie on the arm rests 13 inwardly of the ridges 23. In the event of a frontal impact for the aircraft, the ridges 23 restrain a seat occupant's arms from being thrown outwardly and backwards with resultant injury to the occupant.

Fig. 9 shows the fifth embodiment which again is a rearwardly facing aircraft passenger seat. The seat assembly 30 comprises a shell 31 which mounts a seat base 32, a seat back 33 and two arm rests 34. The

SUBSTITUTE SHEET

seat base and the seat back are separate padded panels. The seat base 32 can be mounted on the shell 31 in a number of positions such that the seat base can be moved forwards or backwards to accommodate different thigh lengths for seat occupants and ensure that the front of the seat is in contact with the back of the occupant's knees. Similarly, the seat back 33 is adjustable upwardly and downwardly to be secured in different mounting positions on the shell 31 to accommodate different shoulder heights, the seat back 23 being extended at the shoulder region to be broader than the width of an occupant's shoulders. A calf support 35 is provided in the form of a padded member which is of a similar width to the seat base 32 and which is mounted on an arm 36 which extends from the underside of the shell 31. The arm 36 is pivotally connected to the shell 31 such that the calf support 35 can be pivoted to suitably contact and support occupant's legs of different length.

The seat assembly 30 has a headrest 37 which is adjustable for height again to ensure that it gives the best possible support.

CLAIMS

1. A seat assembly including a rigid cellular structure, the cellular structure being arranged to absorb impact applied to at least part of the seat by deformation of the cellular structure.

2. A seat assembly as claimed in claim 1, wherein the cellular structure is elongate.

3. A seat assembly as claimed in claim 2, wherein the cellular structure is arranged to absorb impact applied in a lateral direction thereto.

4. A seat assembly as claimed in 1, wherein the cellular structure is wall-like in shape.

5. A seat assembly as claimed in 4, wherein the wall-like cellular structure is arranged to absorb impact applied in a direction perpendicular to the plane of the wall.

6. A seat assembly as claimed in any preceding claim, wherein a cellular structure is provided in a seat base of the seat assembly and is arranged to absorb impact applied downwardly to the seat base.

7. A seat assembly as claimed in claim 6, wherein the cellular structure is wall-like and the plane thereof is substantially parallel to the support surface of the seat base.

8. A seat assembly as claimed in claim 6 or claim 7, wherein the or a cellular structure is arranged to absorb impact applied to the front of the seat base.

9. A seat assembly as claimed in any preceding claim, wherein the seat assembly includes a seat back and the cellular structure is in the seat back.

10. A seat assembly as claimed in claim 9, wherein the cellular structure is arranged to absorb impact perpendicular to the support surface of the seat back.

11. A seat assembly as claimed in claim 9 or claim 10, wherein the cellular structure is wall-like and the plane thereof is substantially parallel to the support surface of the seat back.

12. A seat assembly as claimed in any preceding claim, wherein the seat assembly has a calf support and the cellular structure is in the calf support.

13. A seat assembly as claimed in 12, wherein the

cellular structure is arranged to absorb impact applied to the support surface thereof.

14. A seat assembly as claimed in any preceding claim, wherein the seat assembly has a headrest and the cellular structure is in the headrest.

15. A seat assembly as claimed in claim 14, wherein the cellular structure is arranged to absorb impact applied to the support surface thereof.

16. A seat assembly as claimed in any preceding claim, wherein the seat assembly is an ejector seat.

17. A rigid cellular structure for use in a seat assembly as claimed in any preceding claim.

18. A seat assembly as claimed in any of claims 1 to 16 or a structure as claimed in claim 17, wherein the cellular structure is provided with a layer on one side.

19. A seat assembly or a structure as claimed in claim 18, wherein the cellular structure is provided with a layer on both sides to form a sandwich.

20. A seat assembly as claimed in any of claims 1 to

16 or 18 or 19 or a structure as claimed in any of claims 17 to 19, wherein the cellular structure is a honeycomb structure.

21. A seat assembly or a structure as claimed in claim 20 wherein the honeycomb structure is made from metal sheet.

22. A seat assembly or a structure as claimed in claim 18 or 19 or claim 20 or 21 when dependent on claim 18 or 19, wherein the or each layer is made from metal sheet.

23. A seat assembly or a structure as claimed in claim 21 or 22, wherein the metal sheet is made from aluminium.

24. A seat assembly or a structure as claimed in claim 20, wherein the honeycomb structure is made from a composite material.

25. A seat assembly or a structure as claimed in claim 18 or 19 or claim 20 or 21 when dependent on claim 18 or 19, wherein the or each layer is made from composite material.

26. A seat assembly as claimed in any of claims 1 to

16 or 18 or 19 or a structure as claimed in any of claims 17 to 19, wherein the cellular structure is formed as a foam.

27. A seat assembly or a structure as claimed in claim 26, wherein the foam is an aluminium foam.

28. A seat assembly or a structure as claimed in claim 26, wherein the foam is a urethane foam.

29. A seat assembly as claimed in any of claims 1 to 16 or claims 18 to 28 wherein the seat assembly includes a seat base and the seat base is tiltable backwards.

30. A seat assembly for use as a passenger seat in an aircraft, the seat assembly including a seat base, the seat base being tiltable backwards.

31. A seat assembly as claimed in claim 29 or 30, wherein the seat assembly includes a seat back which is tiltable backwards.

32. A seat assembly as claimed in claim 31, wherein the seat back and seat base are separately tiltable.

33. A seat assembly as claimed in claim 31, wherein

the seat back and seat base are connected so as to be tiltable together.

34. A seat assembly as claimed in claim 33, wherein a structural member of the seat base is integral with a structural member of the seat back such that the seat back and seat base are tiltable together.

35. A seat assembly as claimed in any of claims 29 to 34, wherein the seat base is tiltable to an angle of between 15° and 30° to the horizontal.

36. A seat assembly as claimed in claim 35, wherein the seat base is tiltable to an angle of between 20° and 25° to the horizontal.

37. A seat assembly as claimed in any of claims 29 to 36, wherein a foot rest is provided for use when the seat base is tilted.

38. A seat assembly as claimed in any of claims 29 to 37, wherein a calf support is provided.

39. A seat assembly for use as a rearwardly facing seat in an aircraft, the seat including a calf support.

40. A seat assembly as claimed in claim 38 or 39, wherein the calf support extends downwardly from the front edge of the seat base.

41. A seat assembly as claimed in claim 38 or 39 or 40, wherein the calf support is dimensioned to support substantially the whole length of the calf.

42. A seat assembly as claimed in claims 38 or 39 or 40, wherein the calf support is dimensioned to support at least half of the length of the calf of a seat occupant.

43. A seat assembly as claimed in any of claims 38, 39 and 42, wherein the position of the calf support in relation to the seat base is adjustable.

44. A seat assembly as claimed in any of claims 29 to 43, wherein the seat assembly includes arm rests including portions arranged to inhibit outwards sliding of an occupant's arms off the arm rests.

45. A seat assembly for use as a rearwards facing passenger seat in an aircraft, the seat assembly including arm rests having portions arranged to inhibit outward sliding of an occupant's arms off the arm rest.

46. A seat assembly as claimed in claim 44 or claim 45, wherein each said portion comprises an upstanding ridge along or adjacent the edge of each arm rest.

47. A seat assembly as claimed in any of claims 29 to 46, wherein the seat assembly includes a head rest which extends from the top of the seat back to above the top of the head of a seat occupant.

48. A seat assembly as claimed in any of claims 29 to 47, wherein the seat assembly includes portions on each side of the seat back to inhibit sideways sliding of the body of an occupant.

49. An aircraft including at least one seat assembly as claimed in any of claims 29 to 48, the or each seat assembly being rearwardly facing.

50. An aircraft in which the seats therein are all seat assemblies as claimed in any of claims 29 to 48 and are all rearwardly facing.

Fig. 1

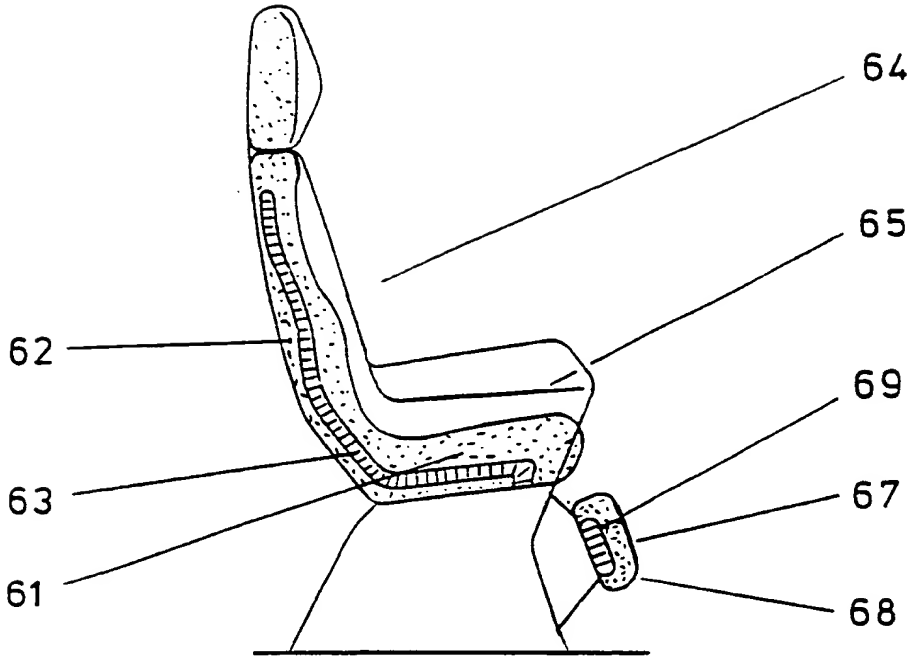


Fig. 2

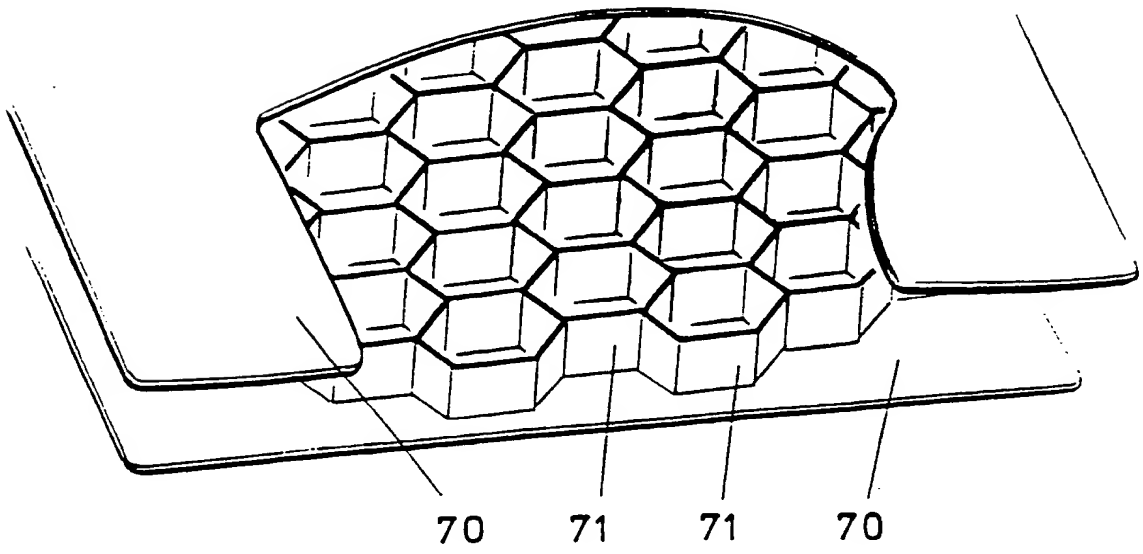


Fig. 3

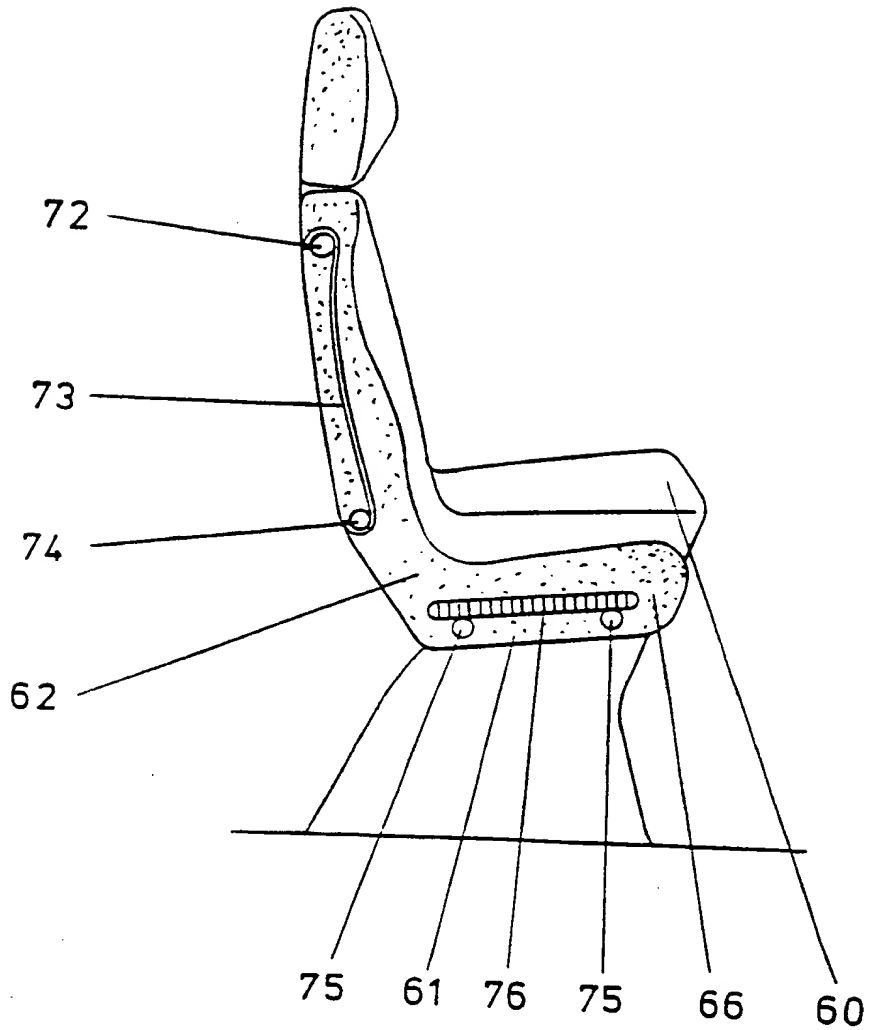


Fig. 4

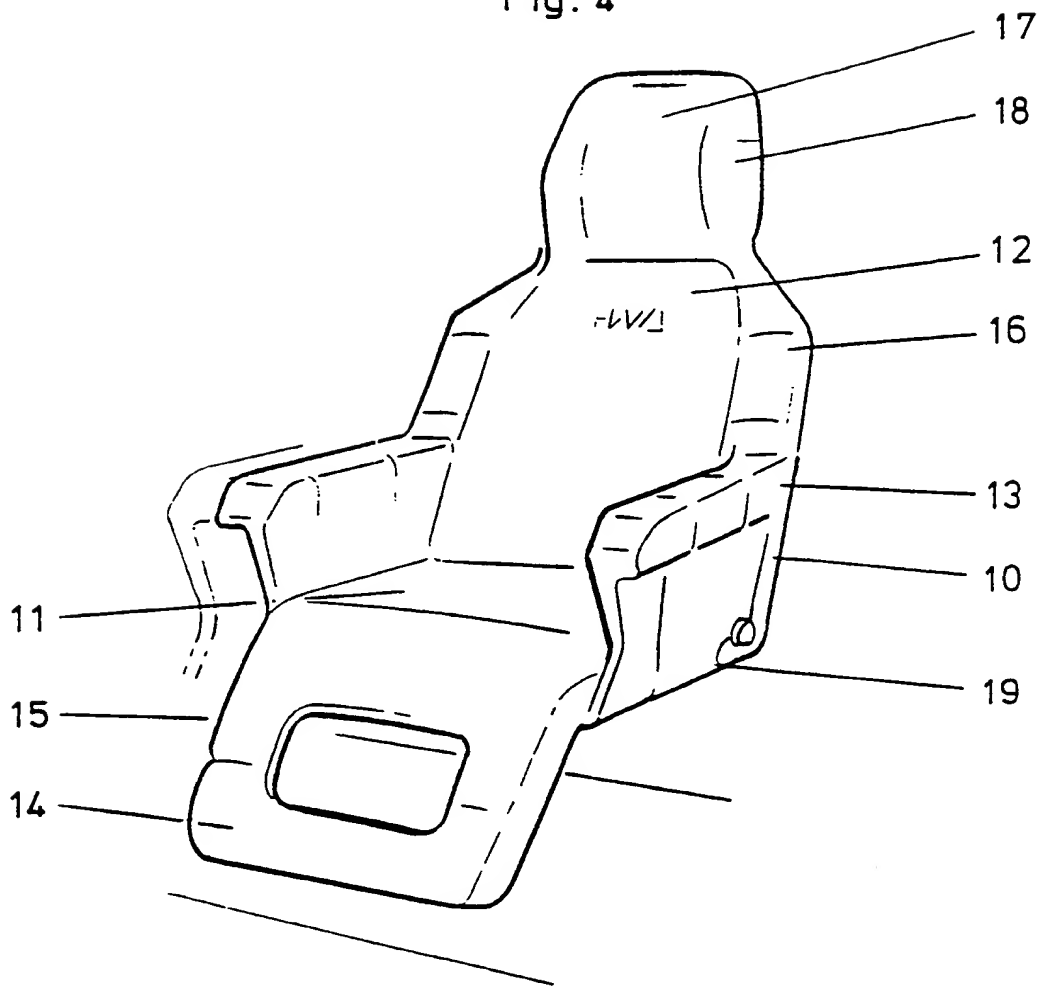


Fig. 5

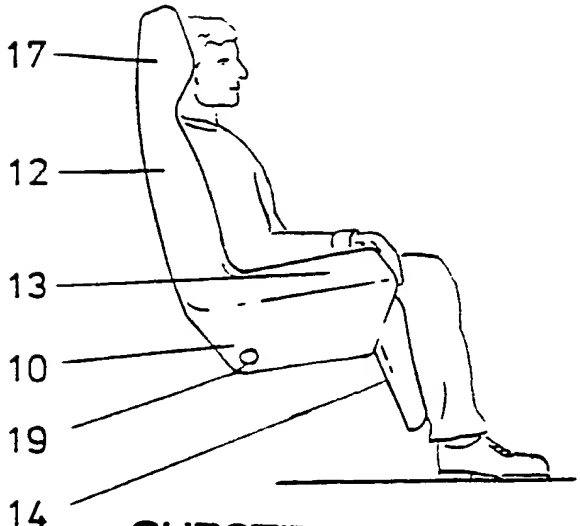


Fig. 6

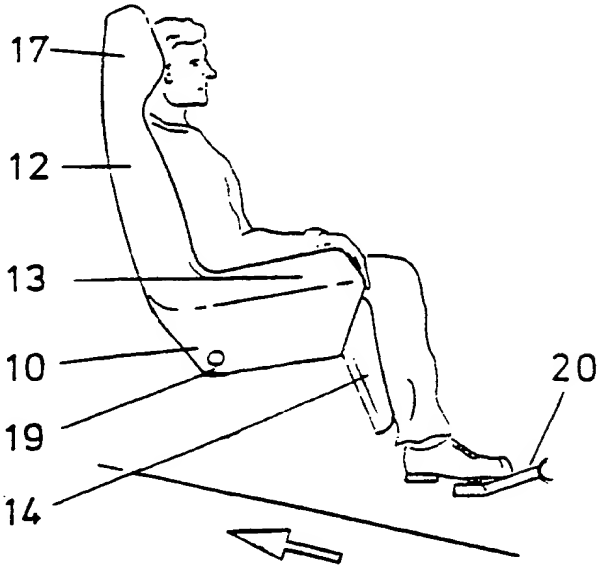


Fig. 7

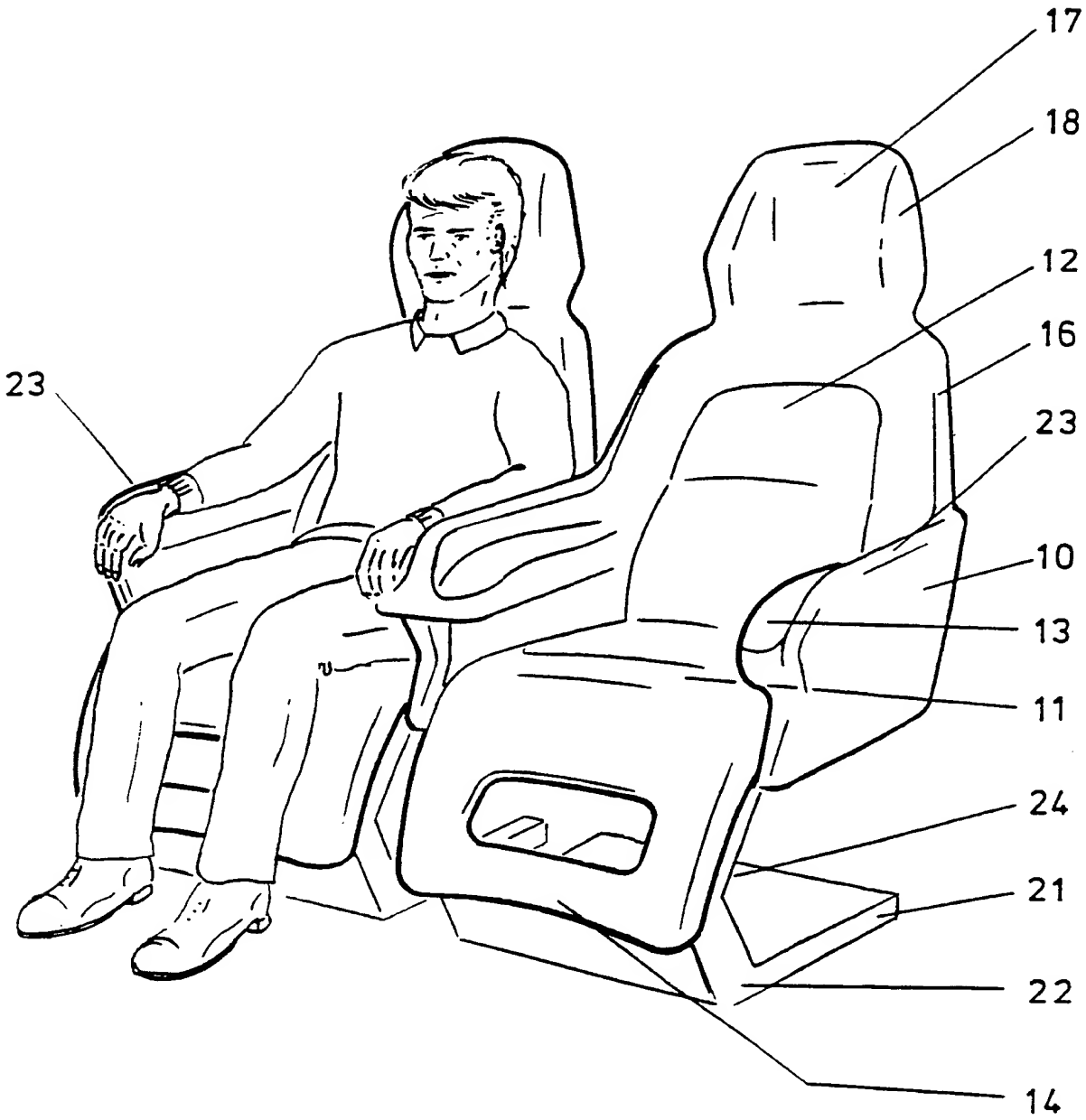


Fig. 8

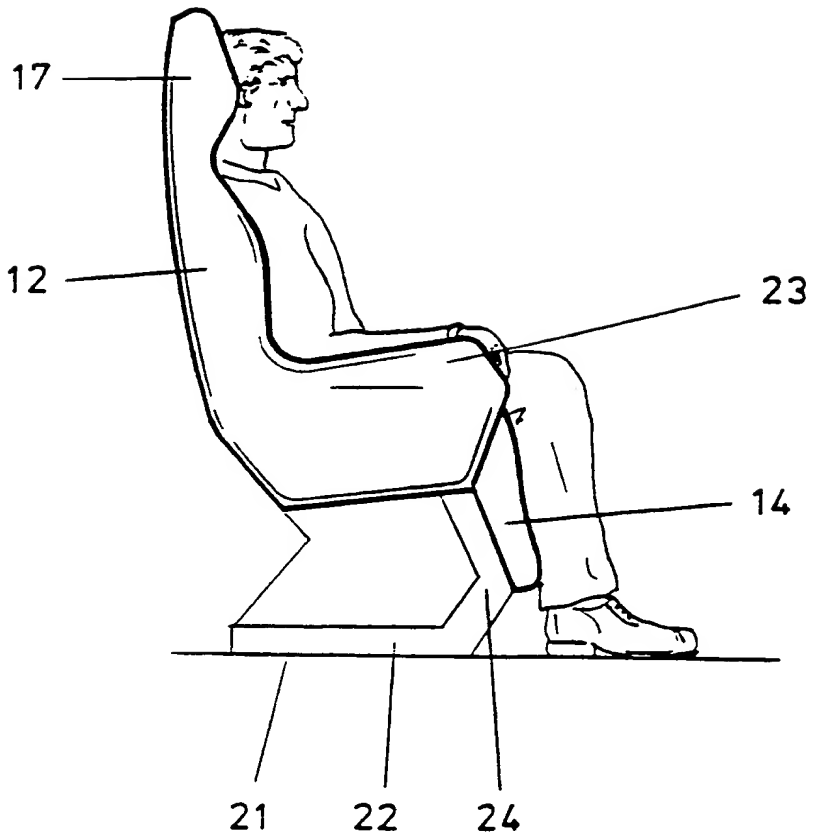
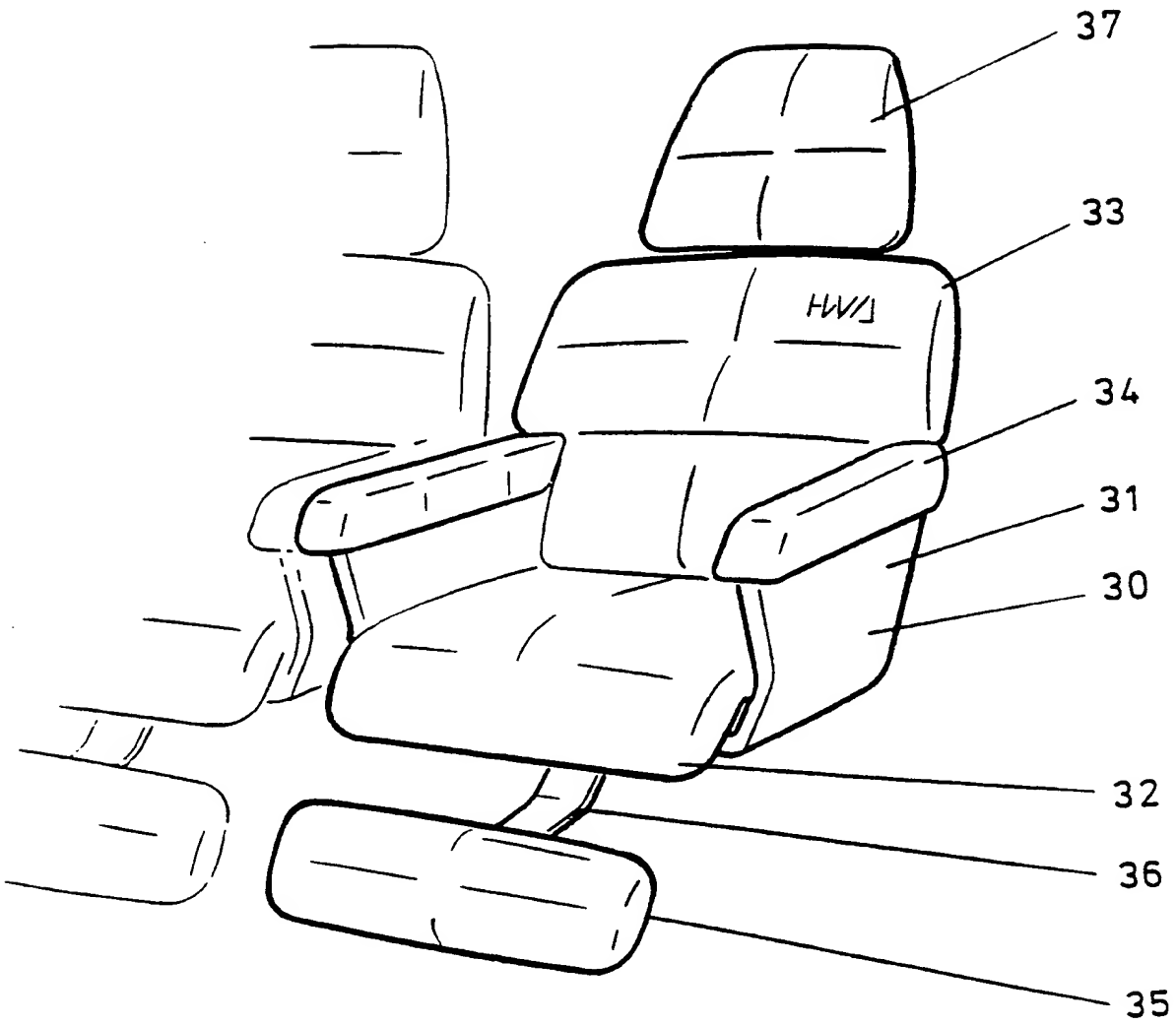


Fig. 9



INTERNATIONAL SEARCH REPORT

PCT/GB 91/01685

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 B64D11/06

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	B64D ; B60N

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
X	US,A,3 000 020 (LOMBARD) 19 September 1961 see column 2, line 45 - column 3, line 10	1,2,4,5, 6,7,9, 10,11, 17,19, 20,21
X	US,A,3 468 582 (JUDD) 23 September 1969 see column 3, line 26 - line 38	1,9,10, 11,20, 21,23,24
A	US,A,4 487 383 (MAZELSKY) 11 December 1984 see column 1, line 67 - column 2, line 3	39,49,50

-/--

° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
18 DECEMBER 1991	07. 01. 92
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	HAUGLUSTAINE H.

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO [redacted]ELEVANT (CONTINUED FROM THE SECO[redacted]EET)

Category °	Citation of Document, with Indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 107 882 (FLIGHT EQUIPMENT & ENGINEERING LTD) 9 May 1984 see page 10, line 12 - line 30	12,30, 31,32, 33,37, 38,40, 41,43
A	DE,A,3 719 105 (KEIPER RECARDO GMBH) 22 December 1988 see column 4, line 48 - column 5, line 63	47,48
A	DE,A,2 152 287 (FAIRCHILD INDUSTRIES INC) 26 April 1973 see the whole document	44,45,46
A	EP,A,0 337 098 (BUDERUS SELL GMBH) 18 October 1989 see the whole document	1
A	US,A,4 031 579 (LARNED) 28 June 1977 see the whole document	26

ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. GB 9101685
SA 51737

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 18/12/91

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-3000020		None		
US-A-3468582	23-09-69	DE-A-	1960658	18-06-70
		FR-A-	2025235	04-09-70
US-A-4487383	11-12-84	None		
EP-A-0107882	09-05-84	AU-B-	563208	02-07-87
		AU-A-	2062283	03-05-84
		US-A-	4635999	13-01-87
DE-A-3719105	22-12-88	None		
DE-A-2152287	26-04-73	None		
EP-A-0337098	18-10-89	DE-A-	3811939	19-10-89
		JP-A-	1306395	11-12-89
		US-A-	4898426	06-02-90
US-A-4031579	28-06-77	None		

EPO FORM P0479

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82